GROUP: CONIFERS AND CYCADS ESA-97-

SPECIES NAME: *Cupressus abramsiana*
(Santa Cruz cypress)

WHEN LISTED: 01/08/87 WHEN DELISTED:

RECOVERY PLAN HISTORY:

✓FINAL PLAN: 09/29/98 PLAN NAME: Santa Cruz Cypress (*Cupressus abramsiana*)

REVISION 1: PLAN NAME:

REVISION 2: PLAN NAME:

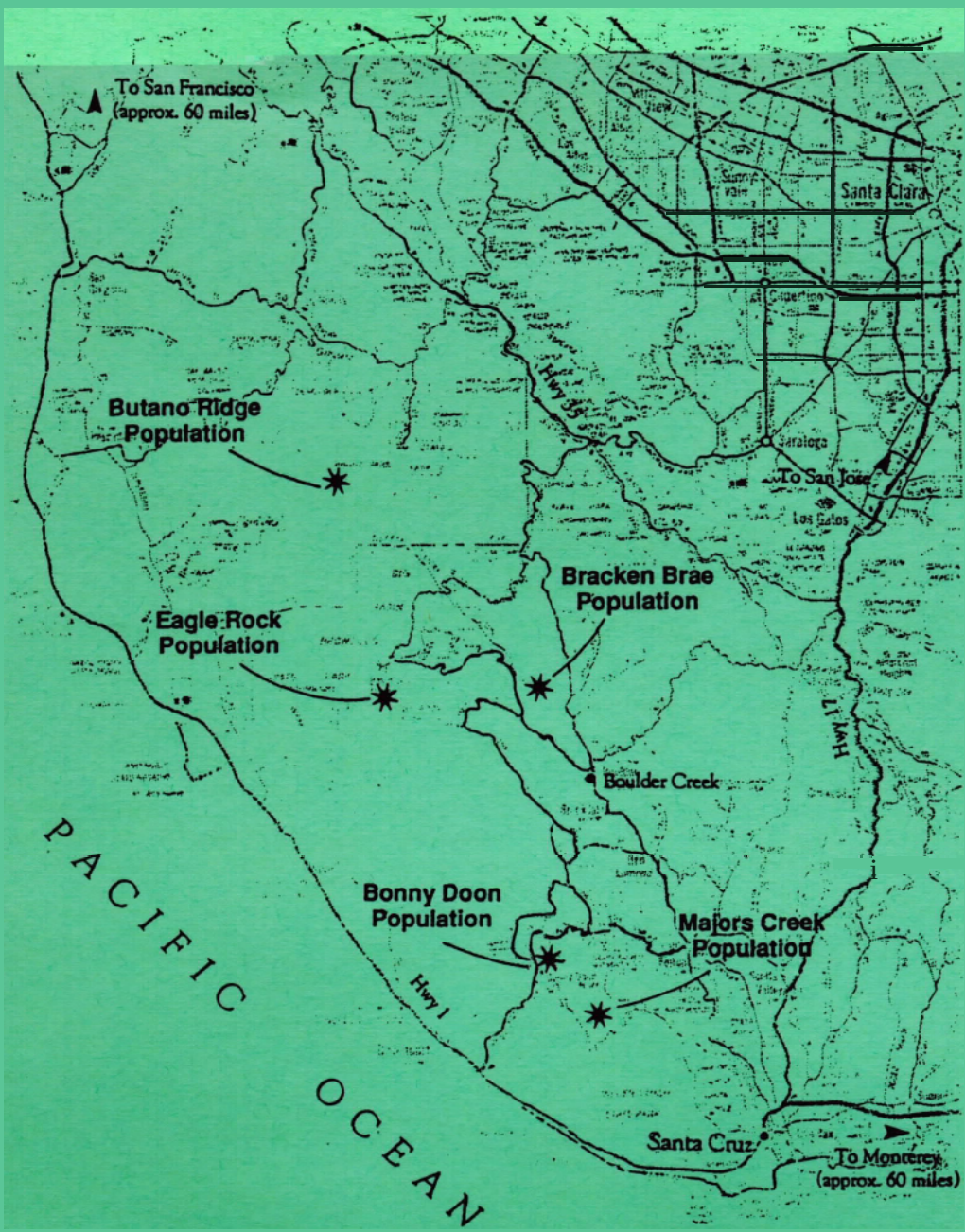
REVISION 3: PLAN NAME:

MULTISPECIES PLAN:

OTHER:

Recovery Plan for the Santa Cruz Cypress

(Cupressus abramsiana)



RECOVERY PLAN FOR THE

SANTA CRUZ CYPRESS

(*Cupressus abramsiana*)

published by
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Portland, Oregon

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September 1998

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Date: 9/26/98

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ACKNOWLEDGEMENT

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EXECUTIVE SUMMARY FOR THE SANTA CRUZ CYPRESS (*CUPRESSUS ABRAMSIANA*) RECOVERY PLAN

Current Status: This species is listed as endangered without critical habitat. Five populations with a total of 5,100+ individuals collectively occupy about 142 hectares (356 acres) along a 24 kilometer (15 mile) range in the Santa Cruz Mountains in Santa Cruz and San Mateo Counties, California.

Habitat Requirements and Limiting Factors: The Santa Cruz cypress occurs in patches within a mosaic of coastal chaparral and mixed evergreen forests, including knobcone pine, ponderosa pine, and redwood forests. Distribution of the cypress is restricted in part by the limited amount of suitable habitat, on soils that tend to be poorly developed, sandy or gravelly in texture, and well-drained.

When this species was listed as endangered, the primary threats were alteration and destruction of habitat due to logging, agricultural conversion, and development. Minor threats to the cypress may be posed by alteration of natural fire cycles, genetic introgression (hybridization with other species of cypress), disease, insect infestation, and competition with alien plant taxa; but the extent of these possible threats has not yet been fully evaluated.

Recovery Objective: Removal from the list of threatened and endangered species.

Recovery Criteria: The species can be considered for reclassification as threatened if progress reported in this plan is confirmed. All five populations and their habitat appear to be secured from the primary threats of logging, agricultural conversion, and development.

The species may be removed from threatened status when all five populations are assured of long-term reproductive success, with insurance against failure provided by the availability of banked seed.

Actions Needed:

1. Secure habitat for populations that are on private land.
2. Conduct research on the life history, ecological requirements, and population demographics of the species that is needed to develop effective management plans for each population.
3. Manage and enhance each population and its habitat.
4. Develop a public education program.
5. Establish an ex situ seed bank.

Recovery Costs (in thousands of dollars), by fiscal year:

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Total
FY1	3	8	0	0	2.5	13.5
FY2	3	6	4.5	0	0.5	14.0
FY3	0	6	5	0.5	0.5	12.0
FY4	0	0	5.5	0.5	0.5	6.5
FY5	0	0	5	0	0.5	5.5
Total	6.0	20.0	20.0	1.0	4.5	51.5

Date of Recovery Objective: Reclassification of Santa Cruz cypress from endangered to threatened status may be initiated as soon as the U.S. Fish and Wildlife Service confirms that all five populations are secured from the imminent threats at the time of listing (logging, agricultural conversion, and development). Delisting from threatened status may be initiated as soon as management plans for all five populations have been developed and implemented, the results of monitoring indicate that populations are stable, a seed bank is established, and no other unforseen and catastrophic threats have developed in the intervening years. The earliest date this could occur would be in five years from the time the recovery plan is finalized.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

A. BRIEF OVERVIEW

Cupressus abramsiana, also known as Santa Cruz cypress and Abrams' cypress, was listed as an endangered plant species by the Federal government (52 FR 679; January 8, 1987) under the provisions of the Endangered Species Act of 1973, as amended. Santa Cruz cypress is also recognized by the California Department of Fish and Game as an endangered species. The U.S. Fish and Wildlife Service (Service) (1987) listed the cypress because it was threatened by imminent residential development, agricultural conversion, and logging. These imminent threats no longer exist, but lesser threats must still be addressed, including genetic introgression and interruption of the natural frequency of fire in the cypress's habitat. Its restricted range means that destruction of even one population by random events would be a severe setback for recovery. The Service assigns recovery priorities to all endangered and threatened species. The Santa Cruz cypress was initially given a recovery priority of 5 on a scale from 1 to 18, with 1 being the highest priority. Unexpected success in removing imminent threats changes the recovery priority to 14, reflecting a low level of threat and high potential for recovery.

This recovery plan summarizes current knowledge of the taxonomy, current distribution, habitat, and biology of the Santa Cruz cypress. The plan recommends measures that, if carried out, will protect and maintain its existing populations and habitat in Santa Cruz and San Mateo Counties, making it possible to reclassify Santa Cruz cypress as a threatened species in the near future, then to remove it entirely from the federal List of Endangered and Threatened Plants.

B. DESCRIPTION AND TAXONOMY

Cupressus abramsiana, a member of the cypress family (Cupressaceae), was first collected by Marcus E. Jones in 1881 probably from Bonny Doon in Santa Cruz County.

Though Santa Cruz cypress populations had previously been included in Sargent (*C. sargentii*) and Gowen cypress (*C. goveniana*), Carl B. Wolf (1948), in his monograph of New World cypresses, described *C. abramsiana* as a new species, naming it after LeRoy Abrams from material collected from Bonny Doon in 1934. Despite noting its intermediate characteristics, Elbert Little (1970) reduced Santa Cruz cypress to a variety of Gowen cypress (*Cupressus goveniana* var. *abramsiana*). Subsequently, Edward Murray (1982), with no explanation, reduced Santa Cruz cypress to a subspecies of Gowen cypress (*Cupressus goveniana* ssp. *abramsiana*). Jim Bartel (1993), however, treated Santa Cruz cypress as a species in his treatment of the genus for the Jepson Manual. Eckenwalder's (1993) treatment for the Flora of North America included *C. abramsiana* in *C. goveniana.*

Wolf (1948) acknowledged that *C. abramsiana* is morphologically intermediate between Sargent and Gowen cypress. In this regard, Kuhlmann (1986) noted that Santa Cruz cypress has slender bright-green branchlets and ovulate cone clusters like Gowen cypress, but it also has large glaucous seeds like Sargent cypress. Along with differences in form (morphology), systematic biologists also compare enzymes (isozymes) or other chemicals produced by plants. The names of the chemicals that are compared are of interest only to specialists. Constance Millar (U.S. Forest Service, Pacific Southwest Forest and Range Experiment Station, pers. comm 1994) noted that the isozymes of Santa Cruz cypress are not distinct from Gowen or Mendocino cypress (*Cupressus goveniana* ssp. *pigmaea*). However, Zavarin et al. (1967) reported that the relative amounts of chemical components characteristic of *C. abramsiana*, *C. goveniana*, and *C. sargentii* are much lower in *C. abramsiana* than the other two species, and this fact seems to support Wolf's thesis that Santa Cruz cypress is intermediate. In addition, Zavarin et al. (1971) reported that *C. abramsiana* and *C. sargentii* have virtually identical leaf chemical components, which would not support treating Santa Cruz cypress as a subspecies or variety of Gowen cypress. Though substrate differences may explain some of the morphological and

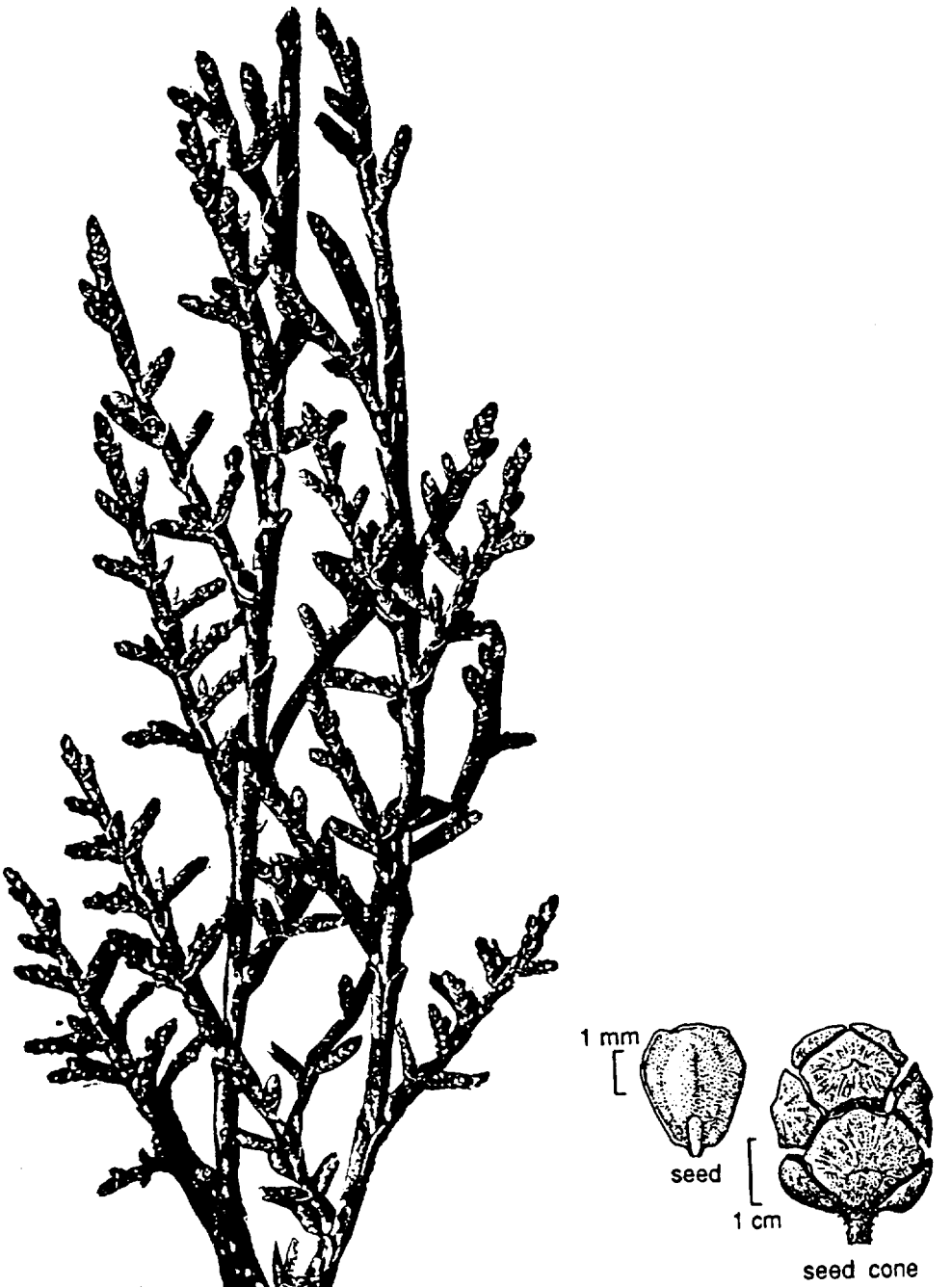
chemical variation (McMillan 1952), recent treatments of *Cupressus* have retained Santa Cruz cypress as a distinct entity (Silba 1981, 1983, 1984, 1986; Bartel 1993).
Figure 1 illustrates the morphology of the branches and cones of *Cupressus abramsiana*. The following description is modified from Bartel's (1993) treatment: *Cupressus abramsiana* is a tree 1 to 25 meters (3 to 82 feet) in height. The grey bark is fibrous, thin, and broken into vertical strips or plates. Young shoots are 1 to 1.5 millimeters (0.06 inch) in diameter and are cylindric. The scale-like leaves are light bright green. The pollen cones are more or less 4-sided, being 3 to 4 millimeters (0.12 to 0.16 inch) long and 2 millimeters (0.08 inch) in diameter. Each pollen cone has 10 to 16 scales.

The seed cones are spherical to widely elliptic. The 8 to 10 brown scales each have a central projection. The seeds are 3 to 5 millimeters (0.12 to 0.14 inch) long and dull brown. The seed has a conspicuous scar where it was attached to the seed cone (Bartel 1993).

C. DISTRIBUTION

Five populations of Santa Cruz cypress are known, all of them in the Santa Cruz Mountains. No historical distribution beyond these five sites is known. The Butano Ridge population is in San Mateo County and the Eagle Rock, Bonny Doon, Bracken Brae, and Majors Creek populations are in Santa Cruz County (Lyons 1988). These five relatively isolated populations range over a distance of 24.2 kilometers (15 miles) from the northernmost population at Butano Ridge to the southernmost at Majors Creek. Table 1 summarizes select data on the five populations. The five known populations encompass approximately 142 hectares (356 acres); their locations are depicted in Figure 2. The geographic distribution of Santa Cruz cypress lies between the distributions of Gowen cypress and Sargent cypress, with Gowen cypress to the south in Monterey County and Sargent cypress to the north in Marin.

Figure 1. Morphology of the branches and cones of *Cupressus abramsiana*



Source: The Jepson Manual
Higher Plants of California, 1993

Table 1. Summary of Population Data for *Cupressus abramsiana*

Population	Approximate Size (Acres)	Number of Individuals	Ownership
Bonny Doon	110	3,000+	Approximately half of the population is owned by the California Department of Fish and Game, and the other half is in 10 parcels owned by various landowners
Eagle Rock	21		Big Basin Redwoods State Park (California Department of Parks and Recreation [CDPR])
Stand 1		100	
Stand 2		100	
Stand 3		500	
Bracken Brae	10	200+	Private landowner (Opler); 5 percent of population is in yards of single family houses.
Butano Ridge	10	200+	Pescadero Creek County Park (San Mateo County Department of Parks and Recreation 1979)
Majors Creek Stands 1 & 2	205	1,000+	70 percent owned by Grey Whale Ranch (CDPR); 30 percent owned by two private landowners.
TOTAL	**356**	**5,100+**	

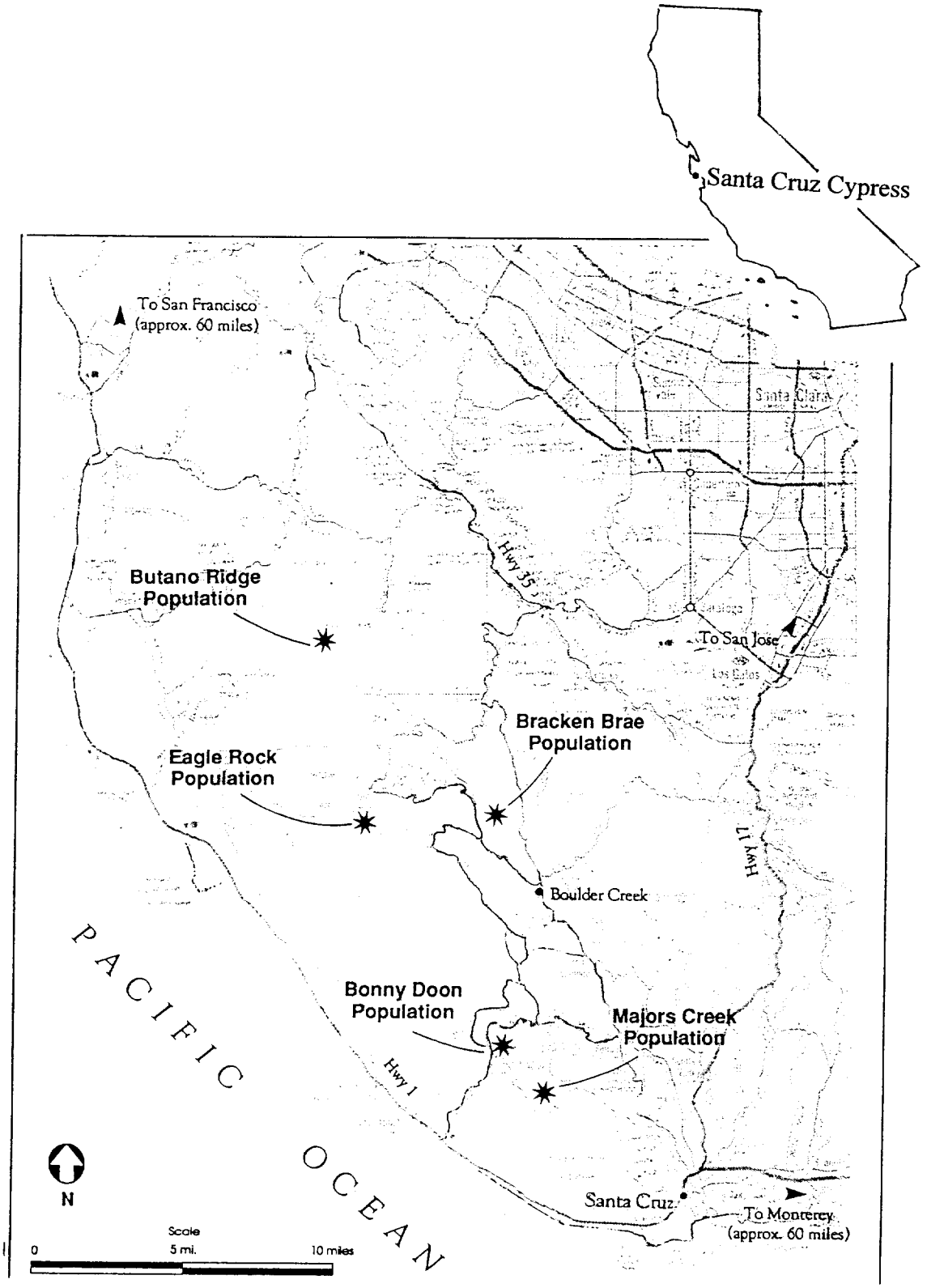


Figure 2. Vicinity maps depicting populations of *Cupressus abramsiana*

1. Bonny Doon Population

The Bonny Doon population is the type locality for the species (i.e., the tree's scientific name is based on a specimen from here), and Bonny Doon is probably the best-known stand (Wolf 1948, McMillan 1952, Carter 1973, and Davilla 1980). The population is located south of the Bonny Doon School in the vicinity of Martin Road in the United States Geological Survey (USGS) Davenport 7.5 minute quadrangle (Figure 3). The majority of this population, since 1989, is protected in the Bonny Doon Ecological Reserve (Jeanine Dewald, California Department of Fish and Game (CDFG), pers. comm. 1993). The Bonny Doon Ecological Reserve is owned and managed by CDFG. The Bonny Doon population consists of over 3,000 trees, occurring over approximately 44 hectares (110 acres) (Lyons 1988). This stand occurs at an elevation of approximately 488 meters (1600 feet) (Griffin and Critchfield 1972). Approximately half of the population is on the Bonny Doon Ecological Reserve, and half is on 10 private parcels (Marilyn Hummel, Bonny Doon resident, pers. comm. 1993).

2. Eagle Rock Population

According to Lyons (1988), the Eagle Rock population consists of three separate stands situated along the crest of Ben Lomond Mountain in the USGS Big Basin 7.5 minute quadrangle, adjacent to the California Department of Forestry's (CDF) Eagle Rock fire lookout station (Figure 4). Two of these stands have approximately 100 trees each, whereas the third stand consists of approximately 500 trees (Lyons 1988). All three stands combined occur on approximately 8.4 hectares (21 acres). This has the highest known elevation of the known populations, ranging approximately from 550 to 760 meters (1800 to 2500 feet) (Griffin and Critchfield 1972). The population is protected in Big Basin Redwoods State Park.

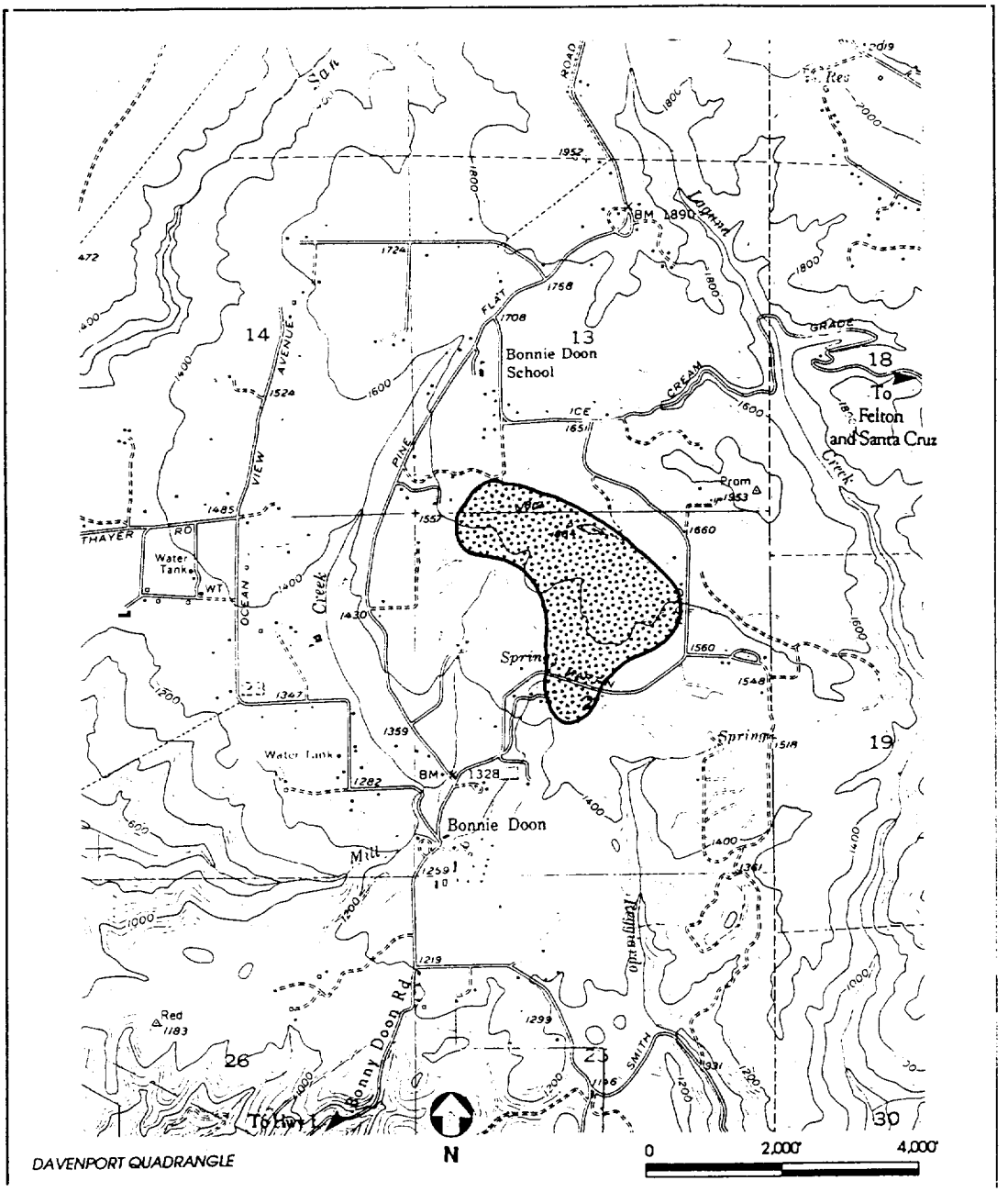


Figure 3. Map of Bonny Doon population.

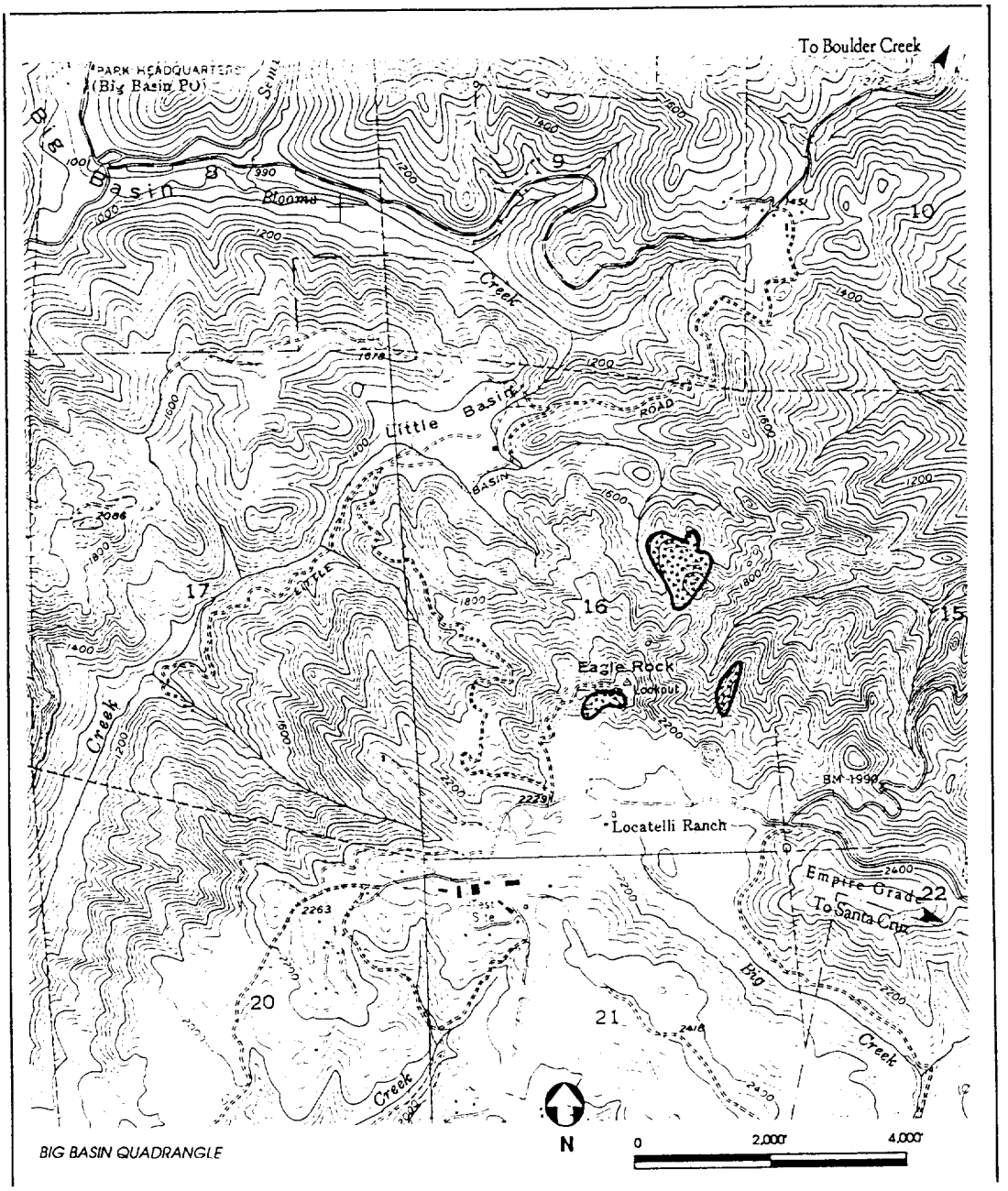


Figure 4. Map of Eagle Rock population.

3. Bracken Brae Population

The population at Bracken Brae is approximately 4.8 kilometers (3 miles) north of the town of Boulder Creek in the USGS Big Basin 7.5 minute quadrangle (Figure 5). The elevation of the population ranges from 280 to 341 meters (920 to 1120 feet) (Griffin and Critchfield 1972). The cypresses are scattered within knobcone pine (*Pinus attenuata)* thickets. Before 1975, this grove occupied about 6.4 hectares (16 acres); however, 2.4 hectares (6 acres) were disturbed by development. The population currently comprises 200 or more trees on 4 hectares (10 acres). The population is on privately-owned lands.

4. Butano Ridge Population

The Butano Ridge population is located along the west-facing slope of Butano Ridge in San Mateo County. The grove ranges in elevation from 378 to 488 meters (1,240 to 1,600 feet), occurring as an island surrounded by redwood forest. The population comprises more than 200 individuals and occupies approximately 4 hectares (10 acres) spanning two USGS 7.5 minute quadrangles, Franklin Point and Big Basin (Figure 6). This is the northernmost population and was first recorded by Professor W.R. Dudley at the turn of the century. The population is protected as part of Pescadero Creek County Park (Roman Gankin, San Mateo County Planning Department, pers. comm. 1993).

5. Majors Creek Population

The fifth and most recently recorded population consists of two stands situated on a north-south ridge approximately 5 kilometers (3 miles) south of Eagle Rock in the USGS 7.5 minute Davenport quadrangle (California Natural Diversity Data Base 1988) (Figure 7). This is known as the Majors Creek population because it is near the headwaters of Majors Creek. The population of over 1,000 individuals occur between the elevations

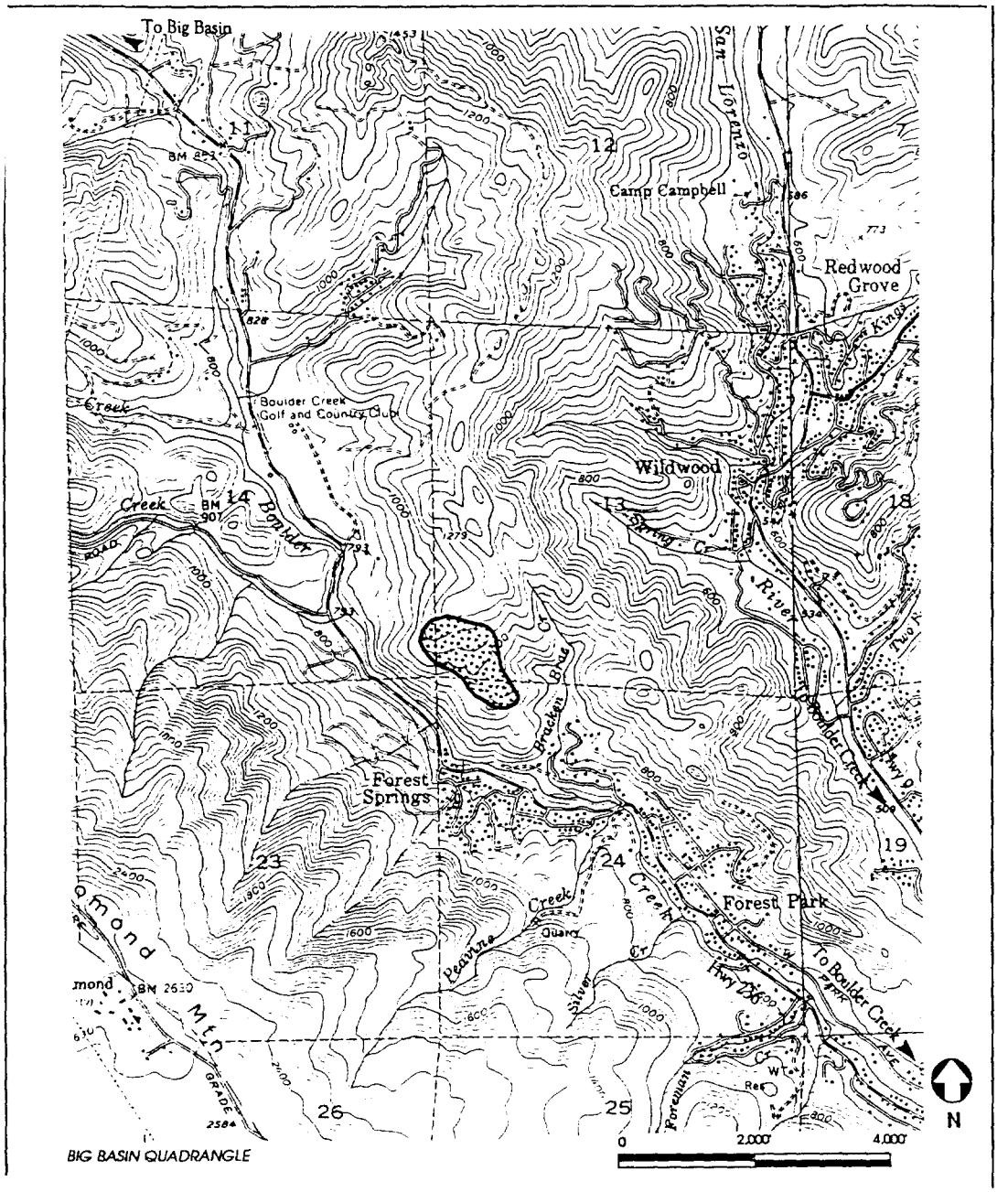


Figure 5. Map of Bracken Brae population.

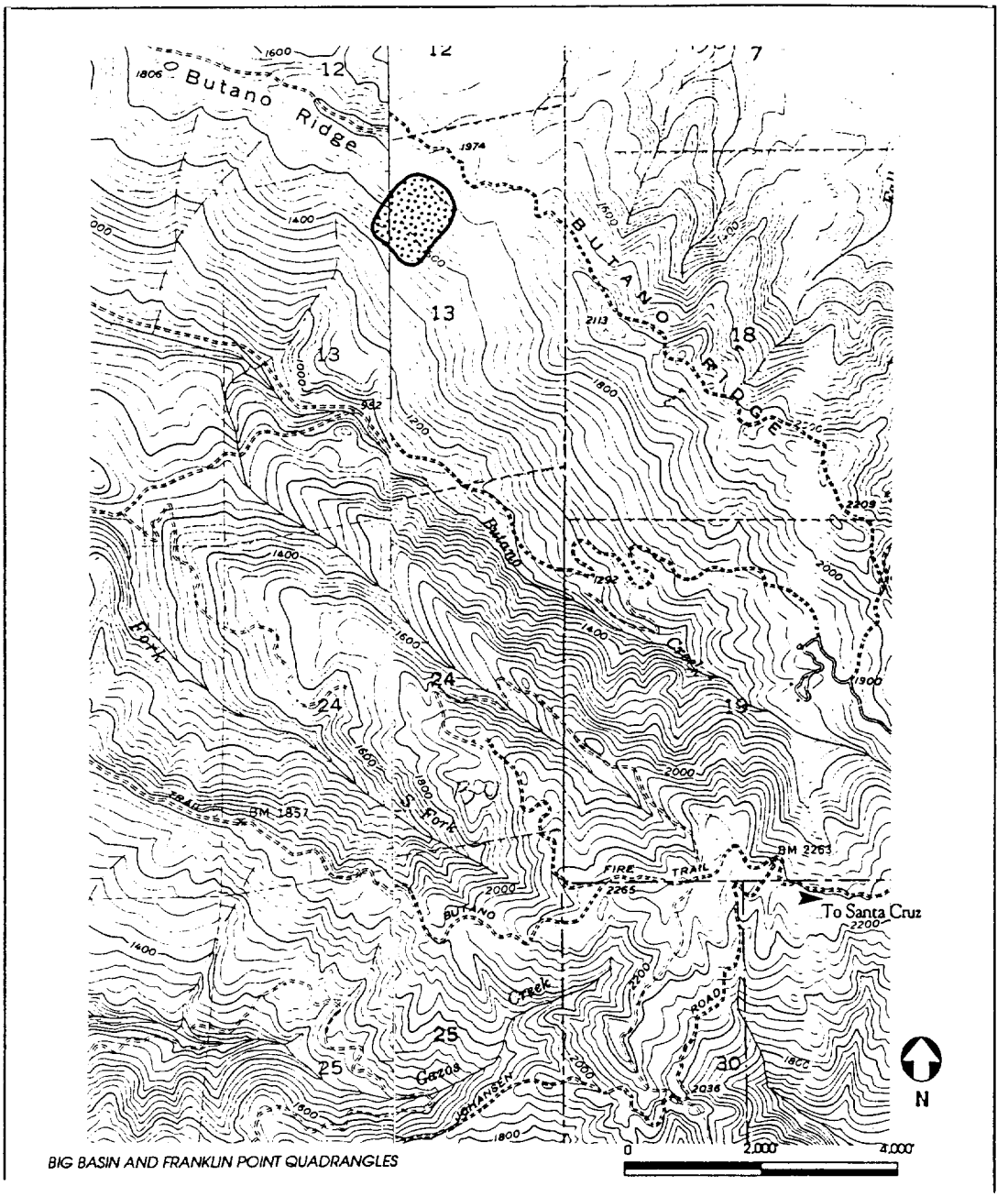


Figure 6. Map of Butano Ridge population.

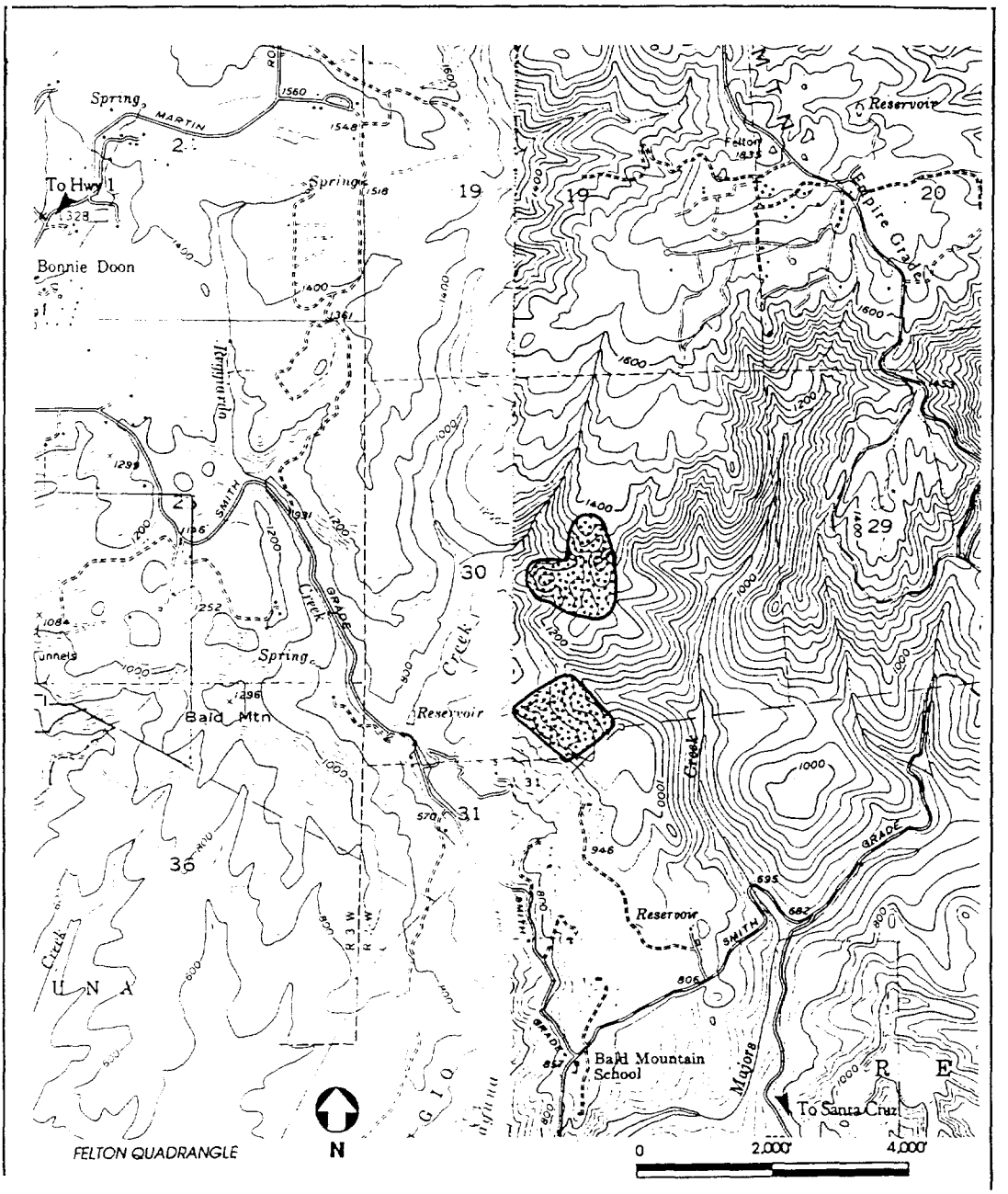


Figure 7. Map of Majors Creek population.

of 300 and 430 meters (1,000 and 1,400 feet) and occupies approximately 82 hectares (205 acres) (Lyons 1988). According to field studies by Davilla (1982), the northern stand is composed of young even-aged trees, while the southern stand is older, with no evidence of seedlings, and no evidence of recent fires (i.e., during the last 30 years). The population was entirely on privately-owned land until 1997, when the CDPR acquired 70 percent of the population. They will be adding it to the Grey Whale Ranch park unit.

D. HABITAT/ECOSYSTEM

All five populations occur on or near dry ridges that are located above the fog belt. The Santa Cruz cypress habitat ranges in elevation from approximately 300 to 760 meters (1,000 to 2,500 feet) in areas having a Mediterranean climate with cool, wet winters and hot, dry summers. According to Vogl et al. (1988), Santa Cruz cypress is mainly associated with chaparral, although some groves contain yellow pine and closed-cone pine forest elements. In the Santa Cruz mountains, cypress does not occur on serpentine soils.

Vogl et al. (1988), listed 19 species often associated with Santa Cruz cypress in the coast ranges of central California. Associated species include: chamise (*Adenostoma fasciculatum)*, silver-leaved manzanita (*Arctostaphylos silvicola*), buckbrush (*Ceanothus cuneatus*), yerba santa (*Eriodictyon californicum*), knobcone pine (*Pinus attenuata*), and ponderosa pine (*Pinus ponderosa*). For the complete list of associates, see Vogl et al. (1988).

Vegetation sampling conducted by Lyons from 1981 to 1988 documented the woody plant species associated with Santa Cruz cypress in the Eagle Rock, Bracken Brae, and Butano Ridge populations. Cypress was the most important species, followed by: chamise, knobcone pine, interior live oak, sensitive manzanita (*Arctostaphylos*

nummularia var. *sensitiva*), and brittleleaf manzanita (*Arctostaphylos tomentosa* ssp. *crustacea*). For further information on associated species, see Lyons (1988).

The Bonny Doon population is associated with species that are either listed by the State or Federal governments or that are species of concern that might require Federal listing in the future. These species include: *Erysimum teretifolium* – Federally endangered, State endangered (CDFG 1993); *Arctostaphylos silvicola* – a species of concern; and *Chorizanthe pungens* var. *hartwegiana* – Federally endangered.

Santa Cruz cypress tends to grow on poorly developed soils that have low water holding capacity and that are low in nutrients. However, the trees usually grow tallest on deep sand profiles. Originally, it was thought that Santa Cruz cypress was restricted to old marine sandstone substrates, consisting mainly of sand (Wolf 1948, McMillan 1952). According to the soil survey (U. S. Department of Agriculture 1976), the Bracken Brae grove occurs on the soil map unit called the xerorthents-rock outcrop complex, 50 to 100 percent slopes. Xerorthent soils are shallow and have formed in material weathered from sandstone or shale. A portion of the Bonny Doon population also occurs on the xerorthents-rock outcrop complex, while another portion occurs on Zayante coarse sand, 5 to 30 percent slopes. Zayante coarse sand is a deep, somewhat excessively drained soil that has formed in residuum weathered from consolidated marine sediment or sandstone (i.e., Santa Margarita sandstone).

The Butano Ridge grove occurs on bare sandstone and shallow sandy soils. The three Eagle Rock groves also occur on the xerorthents-rock complex.

The north grove of the Majors Creek population occurs on the soil map unit called the Sur-Catelli complex, 50 to 75 percent slopes. This complex consists of soils that are on mountainsides and is 35 percent Sur stony sandy loam and 25 percent Catelli sandy loam. The Sur soil is moderately deep, somewhat excessively drained, and formed in residuum derived from sandstone, schist, or granitic rock. The Catelli soil is moderately deep and

well drained and formed in residuum derived from sandstone or granitic rock (ibid.). The southern grove of the Majors Creek population occurs mainly on the soil map unit called Maymen Variant sandy loam, 5 to 30 percent slopes. This soil is shallow (48 centimeters [19 inches] deep) and somewhat excessively drained and formed in material weathered from granite or schist.

All of these soils are sandy or gravelly, and therefore are well-drained and porous. Soils derived from Santa Margarita sandstone are shallow, poorly developed, low in organic content, and very low in the major nutrients (U.S. Department of Agriculture 1977). The above soils information is based on general soil maps, which may not represent the exact soil types at the population sites. Further study is needed to determine the exact soil types (Steven Singer, Soil Conservationist, pers. comm. 1995).

E. LIFE HISTORY/ECOLOGY

Like most cypresses, Santa Cruz cypress has cones that are late to open (serotinous) (Johnson 1974). The cones remain on the tree and remain closed until the vascular connection with the parent plant is severed. Normally, secondary growth eventually causes the cone's stalk to break, which cuts off the vascular water supply, resulting in the release of seeds as the cones dry and open (Daubenmire 1974). However, mechanical breakage or the heat of a fire could also trigger such opening (Barbour et al. 1980).

Cone and Seed Characteristics

Kuhlmann (1986) studied cone and seed production in Santa Cruz cypress. Santa Cruz cypress reaches reproductive maturity at an average age of 11 years (although some individuals produce cones at 6 years [Robert Sohl, private landowner, pers. comm. 1995]). The ovulate cones take 2 years to mature with seeds maturing at 15 to 18 months after pollination. Seeds are released at a slow rate throughout the life of the tree.

Kuhlmann also found that seed viability decreases as cones become older. In 12-year-old cones, approximately 53 percent of the seeds were viable, while in 30-year-old cones, only 10 percent were viable.

Unlike seeds of other conifers, cypress seeds lack wings that would aid in dispersal; consequently, their natural ability to disperse is limited. However, squirrels have been observed to facilitate Santa Cruz cypress cone/seed dispersal by chewing off branch tips, causing portions of branches with cones to fall to the ground (M. Hummel, pers. comm. 1993).

Seedling Establishment

Like other pioneer conifers, cypress seedlings survive best in full sunlight on bare mineral soils lacking litter. This being the case, disturbance of the substrate through fire or other mechanisms may enhance the rate of seedling establishment. According to studies by Kuhlmann (1986), in the Bracken Brae population, seedlings and saplings established in areas that were clear of trees and shrubs, whereas seedlings did not establish in areas having trees and brushy thickets. Kuhlmann noted approximately 100 saplings in a clear area of decomposed sandstone that had signs of recent erosion and slumping. At the Majors Creek population in 1993, dense seedling establishment was observed in areas that were recently graded (Brock Dolman, Bonny Doon resident, pers. comm. 1993). Seedlings also appear to grow well directly beneath the parent trees (R. Sohl, pers. com. 1995).

On one of the privately owned parcels associated with the Bonny Doon population, a storm in 1968 resulted in fallen trees. The owners cleared the property of branches, and the mechanical abrasion to the cones resulted in sprouting of hundreds of seedlings and a uniform grove of Santa Cruz cypress that was 25 years old in 1993 (M. Hummel, pers. comm. 1993). Therefore, fire is not a requirement for the release of seeds from dispersed cones.

Population Demographics

The demographic characteristics of three populations (Eagle Rock, Bracken Brae, and Butano Ridge) were studied by Lyons (1988). A linear regression correlating tree diameter with age in the Eagle Rock population showed that the mid-sized size class (7.7 to 12.7 centimeters [3 to 5 inches] in diameter) represented trees that are less than 40 years old, while the largest size class represents trees that are upwards of 100 years old (Lyons 1988). In the three stands that make up the Eagle Rock population, the largest percent of trees fell within the mid-sized size class, with fewer trees in the smaller and larger size classes. In the Bracken Brae population, the largest percent of trees fell within the smallest size class (less than 2.5 centimeters [1 inch] in diameter), with most of the remaining trees in the 2.5 to 7.6 centimeter [1 to 2.9 inch] diameter size class, and only a few larger individuals. The Butano Ridge population shows a similar profile to the Eagle Rock population, with the largest percent of trees falling within the mid-sized size class, and fewer trees falling within smaller and larger size classes. No demographic data are available for the Bonny Doon or the Majors Creek populations.

Areas supporting saplings have the highest density of trees, while the lowest densities are in areas with trees in larger size classes. Kuhlmann (1986) found first-year saplings to reach a density of 1,000 trees per hectare (405 trees per acre) in the Bracken Brae population, and Lyons (1988) found a density of 8,625 trees per hectare (3,492 trees per acre) "in an area of recent disturbance." As with many long-lived plant species, mortality in Santa Cruz cypress probably is high during the early years of stand development, with older stands approaching a constant density that is independent of initial sapling density.

The demographic profiles of the three populations indicate that stand senescence and loss of reproductive potential are not currently a concern for maintaining long-term viability of the Santa Cruz cypress.

The Role of Fire in Maintaining Population Viability

The presence of serotinous cones and the observation that certain even-aged stands are correlated with known fire events can lead to the conclusion that Santa Cruz cypress is a "fire adapted" species. According to Bartel and Knudsen (1982), the cones "remain closed and retain their seeds until the tree or supporting branch dies, generally as a result of fire. The serotinous cones enable the cypresses to drop abundant quantities of seeds after a typical fire burns a grove."

Many workers agree that Santa Cruz cypress does not require fire for regeneration (Bartel and Knudsen 1982, Kuhlmann 1986, Lyons 1988, Vogl et al. 1988), and numerous observations support this position. Scattered young Santa Cruz cypress were observed in the Majors Creek population that were ten years in age, yet there had been no recent fires, and 20 young seedlings were observed along an old road in the Bonny Doon population (Deborah Hillyard, California Department of Fish and Game, pers. comm. 1995); this indicates that some reproduction will occur in the absence of fire (Davilla 1982). (Also see section on "seedling establishment" above.)

Whether fire is an important mechanism for maintaining stand viability is open for discussion. In the Bonny Doon population, the majority of the trees are mature, aging specimens (Valerie Haley, The Habitat Restoration Group, pers. obs. 1993), and Davilla (1980) noted that the lack of seedling establishment in the Bonny Doon population has been attributed to fire exclusion. A key factor may be the frequency of fire events. If fires are too frequent (i.e., less than 10 years), then young cypress trees would not be able to reach reproductive age and the grove could be extirpated. Conversely, the prolonged absence of fire (i.e., 200 years or more) could result in stands of old trees with little ability to spread seed after a fire. This could lead to extirpation of the grove (Bartel and Knudsen 1982). For the Santa Cruz cypress, the natural fire frequency is estimated to be between 50 and 100 years with a minimum of 20 years between fires to avoid extinction (ibid.). Other botanists have estimated that a fire frequency of 35 to 40 years will restore population vitality (Vogl et al., 1988, summarized in Davilla 1980). However, a

frequency of 50 to 100 years may be more appropriate in maritime locations (D. Hillyard, pers. comm. 1995).

F. REASONS FOR LISTING AND CURRENT THREATS

Santa Cruz cypress was listed by the Service as an endangered species because, at the time of listing (1987), all five populations of Santa Cruz cypress faced one or more of the following threats: residential development, logging, agricultural conversion, genetic introgression, and disruption of the natural fire frequency (U.S. Fish and Wildlife Service 1987). Some of the threats at the time of listing have been addressed or removed, as explained in the "Conservation Measures" section, below. Current and potential threats to the species are summarized below.

1. Oil and Gas Drilling — A potential threat to the Butano Ridge population may arise from oil and gas drilling (U.S. Fish and Wildlife Service 1987). The portion of the population that is part of Pescadero Creek County Park was transferred to the Park from the U.S. Bureau of Land Management (BLM); however, BLM reserved the oil and gas rights. In the 1980's, drilling attempts failed and drilling operations were closed down, so oil and gas drilling is not currently a threat. Approval of any future oil and development plans is the responsibility of the BLM.

2. Construction and Timber Harvest — All populations show signs of past disturbance and/or construction related activities (ibid.). In 1975, nearly one-third of the Bracken Brae population was destroyed by the development of 40 homes by Galleon Properties, Inc. (Libby 1979). Since 1975, there has been no further residential development in the vicinity of the Bracken Brae population; however, the population continues to be subject to indirect impacts from the adjacent housing development, such as soil erosion, wood cutting, insect infestation, and invasion by weedy, non-native plant species. The bulk of the population occurs on a 16 hectare (40 acre) parcel owned by Andy Opler (Sal Maleti,

adjacent landowner, pers. comm. 1993). Smaller portions of the population occur on an adjacent 5.6 hectare (14 acre) parcel owned by Mr. Maleti and an adjacent 16 hectare (40 acre) parcel of unknown ownership.

In 1993, Mr. Maleti owned all three parcels and proposed a timber harvest. A timber harvest plan was approved by California Department of Forestry and Fire Protection in 1993. The timber harvest plan excluded any harvest of cypress trees, but included a logging haul road through a portion of the cypress population. The County of Santa Cruz filed an appeal with the State Board of Forestry to halt issuance of the permit based upon opposition from the adjacent residential property owners, and the permit was revoked.

The Majors Creek population was threatened by nearby logging operations proposed in the Majors Creek timber harvest site. In 1982, the Majors Creek timber harvest site was surveyed for rare and endangered plants. Two groves of Santa Cruz cypress were found adjacent to the boundary of the timber harvest area (Davilla 1982). The timber harvest plan should result in minimal direct impacts to the two groves; however, tree harvest operations, including graded roads and bare soils, could result in wind and water erosion problems that could undermine cypress trees adjacent to the harvest areas (ibid.).

The small portion of the Butano ridge population that is under private ownership was threatened by logging operations conducted by Big Creek Lumber. However, the cypress trees were not harmed due to their limited value as a lumber tree (U.S. Fish and Wildlife Service 1986).

3. Agricultural Conversion — Plans to convert portions of the Bonny Doon population into a vineyard were abandoned when an environmental review found numerous occurrences of rare and endangered plant species and unique wildlife habitat on the Bonny Doon Ranch (Davilla 1980). Agricultural conversion of the majority of the population is no longer a threat, as the Bonny Doon Ranch was purchased by The Nature

Conservancy in 1989, and then deeded to the California Department of Fish and Game as an ecological reserve (J. Dewald, pers. comm. 1993).

4. Reproductive Isolation — Santa Cruz cypress is also considered endangered because it has a limited range on the central coast of California. The population locations are all relictual islands containing representatives of what once was a widespread flora during glacial times (Libby 1979). It is likely that the limited range of Santa Cruz cypress today is due to the restricted availability of suitable habitat. Preliminary findings indicate that Santa Cruz cypress is restricted to certain soil types that are poorly developed and have low water holding capacity and low nutrients. The isolation of the five populations from one another precludes interchange of genetic material, and therefore morphological variations (i.e., cone characteristics) occur between the populations, with each population having genetic differences (McMillan 1952). Historical distribution beyond these five sites is unknown.

5. Introgression — If individuals of different cypress species are planted in close proximity, they can exchange pollen and produce fertile hybrid offspring. By this means, genes from one species can infiltrate into another, a process called introgression. Santa Cruz cypress may be affected by introgression from residential plantings of Monterey cypress (*Cupressus macrocarpa*), as observed near the Bonny Doon population (V. Haley, pers. obs., 1993) and Arizona cypress (*Cupressus glabra*), observed near the Eagle Rock population (D. Hillyard, pers. comm. 1995).

The potential for introgression from planted cypresses to affect Santa Cruz cypress has to be assessed and remedied, if necessary. To assess the threat, it is helpful to know how much genetic variation exists within Santa Cruz cypress populations, between populations, and between Santa Cruz cypress and the neighboring coastal cypress species—Gowen cypress and Monterey cypress. C. Millar (pers. comm. 1994), noted that considerable genetic variation exists within each Santa Cruz cypress population. Between populations, about as much genetic variation exists as there is between Santa

Cruz cypress and the neighboring species. This pattern of variation suggests that in the absence of geographical barriers, hybridization would occur among the different populations of Santa Cruz cypress as well as between Santa Cruz cypress and the neighboring species.

6. Disease and Predation — The degree of threat to Santa Cruz cypress due to disease or predation is in need of further study. According to Wagner (1948), Santa Cruz cypress is "quite susceptible" to cypress canker (*Corneum cardinale*). In 1992, a sawfly infestation was observed in the Bracken Brae population (Richard Taylor, local resident, pers. comm. 1992) and "borers" were found to be the cause of the death for several other trees (M. Hummel, pers. comm. 1995). The sawfly larvae most likely originated from adjacent landscape plantings. If so, such plantings may pose a threat to Santa Cruz cypress by harboring pests.

7. Competition with Non-native Plant Species — Openings within Santa Cruz cypress habitat resulting from grading for housing developments and logging roads have promoted the establishment of French broom (*Genista monspessulana*), and may promote the establishment of pampas grass (*Cortaderia jubata*) (S. Singer, pers. comm. 1995). Both of these invasive, non-native plants compete with native plant species; within cypress habitat, French broom and pampas grass may preclude cypress seedlings from establishing. Although these two species are found within cypress stands on disturbed sites, no monitoring or studies have been conducted to determine if French broom and pampas grass will spread from these disturbed sites to other open but otherwise undisturbed sites within cypress stands.

8. Lack of Adequate Legal Protection — Although Santa Cruz cypress is listed as endangered under the California Endangered Species Act (CESA), this designation provides little protection for the plant on private lands. Under the California Department of Fish and Game's current interpretation, the "take" prohibition provision for plants in CESA incorporates the Native Plant Protection Act (NPPA) take prohibition. As

currently interpreted, NPPA requires only that landowners notify the California Department of Fish and Game 10 days in advance of a change of land use to allow the Department to salvage the plants; however, the cases in which this salvage notice requirement applies are still in question. In general, most projects that would impact an endangered species require review under the California Environmental Quality Act (CEQA), which can provide a greater level of protection for Santa Cruz cypress. The CEQA provides that when a lead agency approves a project, it must require mitigation of significant adverse impacts where feasible, or must issue a statement of overriding considerations if it finds that the project's benefits outweigh its adverse impacts.

At the time Santa Cruz cypress was federally listed, it was already protected under the Santa Cruz County Local Coastal Program (LCP) (Santa Cruz County 1980) and the Santa Cruz County General Plan (Santa Cruz County 1984). With the recent combined revision of the Local Coastal Program and General Plan (Santa Cruz County 1994), this protection has been strengthened. All Santa Cruz cypress stands are identified as Special Forests, which in turn are identified as one of a number of Sensitive Habitats. The only uses allowed within Sensitive Habitat areas are those that depend on the Habitat's resources, except for other uses that are: "(a) consistent with protection policies and serve a specific purpose beneficial to the public; (b) it is determined through environmental review that any adverse impacts on the resource will be completely mitigated and that there is no feasible less-damaging alternative; and (c) legally necessary to allow a reasonable economic use of the land, and there is no feasible less-damaging alternative." (Santa Cruz County 1994). Furthermore, land divisions are prohibited in Special Forests, and proposed developments must meet a number of specific site design and use regulations designed to protect sensitive habitats against significant disruption or degradation of habitat values.

The California Department of Forestry and Fire Protection (CDF) issues permits for three types of activities: timber harvesting, agricultural burning, and dooryard (rural residential) burning. Issuance of the first two permits is discretionary, and includes a review process

to determine potential impacts to sensitive resources. Dooryard burning is typically confined to an incinerator or pile, and therefore the issuance of the permit constitutes an administrative procedure. Although one proposed timber harvest would have included construction of a logging haul road through a portion of the Bracken Brae population, this proposal was legally blocked by neighbors. No other timber harvesting activities are known to have had, or are planning to have, direct impacts to Santa Cruz cypress.

9. Disruption of Natural Fire Cycles — The sustainability of cypress populations could be affected by the disruption of natural fire frequency cycles. Due to the proximity of most of the populations to residential areas, natural fires have been suppressed, thereby lengthening the interval between fires. With suppression, an unnatural buildup of fuels could result in high intensity fires that could kill trees (George Gray, Calif. Dept. of Parks and Rec., pers. comm. 1995). However, most stands of Santa Cruz cypress do not exhibit an understory as developed as those in other forest types, meaning there may be little fuel buildup. Therefore, a decrease in fire frequency may be less of a concern in Santa Cruz cypress stands than in other forest types.

Conversely, fire intervals shorter than normal, resulting from human-caused fires, could inhibit Santa Cruz cypress from reaching its reproductive potential. However, at the present time, no indication exists that fire cycles are either too short or too long to affect the long-term viability of the cypress stands.

G. CONSERVATION MEASURES

The Endangered Species Act of 1973, as amended, requires the Service to develop a recovery plan that describes "site-specific management actions" necessary for the conservation and survival of Santa Cruz cypress. The plan must have "objective, measurable criteria which, when met" will allow the cypress to be removed from the Federal list. The plan must estimate the time needed, and the cost to carry out the

conservation measures. After Santa Cruz cypress is removed from the list, the U.S. Fish and Wildlife Service must, in cooperation with the State of California, "effectively monitor for not less than five years" the cypress's status, and the Service must be prepared to restore the cypress to the list if necessary. The Endangered Species Act also authorizes the Department of the Interior to acquire habitat essential to preserving listed endangered species.

At the state level, the California Environmental Quality Act (CEQA) provides some protection for endangered species through the environmental review process. Initially, a public agency reviews a project to determine if it would create negative impacts to Santa Cruz cypress. If the impacts are not considered significant, a formal environmental impact report (EIR) is not required, and the project is granted a Negative Declaration with measures/recommendations to reduce environmental impacts. If the project's impacts are considered significant, an EIR is required, consisting of a description of existing site conditions, impact analysis, and detailed mitigation measures that would reduce project impacts to a less-than-significant level. Mitigation measures such as avoidance, fencing, or landowner education programs must be incorporated into the approved project, and may provide long-term species protection. But if no mitigation measures are feasible and if the lead agency determines that benefits of the project outweigh the environmental risks, it may approve a project by making a statement of overriding considerations.

Other California laws and regulations that apply to Santa Cruz cypress include the California Forest Practices Act, which applies to timber harvesting on sites greater than 1.2 hectares (3.0 acres); the California Surface Mining and Reclamation Act of 1975; California Department of Fish and Game (CDFG) policies, as they relate to management of reserves; and California Department of Parks and Recreation (CDPR) policies.

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The following conservation/recovery efforts have already been implemented for Santa Cruz cypress:

1. As of 1993, about half of the Bonny Doon population is being protected and managed by the CDFG as part of the Bonny Doon Ecological Reserve (J. Dewald, pers. comm. 1993).

2. The Eagle Rock population is located within Big Basin Redwoods State Park. The land was purchased in 1987 by a local land conservancy, the Sempervirens Fund, which then sold it, using State Park matching funds, to the California Department of Parks and Recreation. The major reason for acquiring the parcels was to protect the grove of Santa Cruz cypress (Verl Clausen, Sempervirens Fund, pers. comm. 1994).

3. The Bracken Brae population is all on privately-held land; however, in the 1970's a Cypress Defense Fund was established in association with the California Native Plant Society to promote protection of the grove. One property owner, Mr. Maleti, expressed interest in selling the property to a local land conservancy, such as Santa Cruz County Land Trust, but funding was not available (S. Maleti, pers. comm. 1993).

4. The Santa Cruz County General Plan (1994) recognizes Santa Cruz cypress as a sensitive botanical resource to be protected. A Santa Cruz County sensitive habitat ordinance protects the cypress groves from development such as land divisions and subdivisions, but does not protect the groves from activities relating to existing single family dwellings or timber harvest. The County Local Coastal Plan (Santa Cruz County 1980, page 26) also recognizes the Bonny Doon and Majors Creek cypress groves as a special forest and environmentally sensitive habitat. Such habitats are protected against any significant disruption of their habitat values, and only uses dependent on such resources shall be allowed within the sensitive habitat area; uses include nature education, research, hunting, fishing, and aquaculture (Santa Cruz County 1980). Development in areas adjacent to environmentally sensitive habitat areas "shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas" (ibid.).

5. A Santa Cruz County ordinance implements the County's General/LCP Plan policy to provide for deed restrictions of private lands where Santa Cruz cypress occurs.

No disturbance (i.e., cutting trees or grading) is allowed on private lands supporting Santa Cruz cypress. A 50-foot (15 meter) buffer between such habitat and adjacent development is also required.

6. The Butano Ridge population is protected from development because it is located within Pescadero Creek County Park, under the jurisdiction of the San Mateo County Department of Parks and Recreation (U.S. Fish and Wildlife Service 1987). The park was given to San Mateo County by the BLM in 1975. Pescadero Creek County Park has developed a Resource Management Plan for the watershed's biotic resources, but the plan does not specifically address Santa Cruz cypress and it has never been formally implemented. Development of a Coordinated Resource Management Plan (CRMP), which included management of Santa Cruz cypress, was begun in 1992 but was delayed due to the County's lack of funds (R. Gankin, pers. comm. 1993). The Butano Ridge population is also protected by the San Mateo County heritage-class tree ordinance, which regulates the removal and trimming of native trees through the California Department of Forestry permitting process (R. Gankin, pers. comm. 1993). All Santa Cruz cypress trees, regardless of size, are protected from removal/trimming unless a Timber Harvesting Permit specifically authorizes these actions.

7. Seventy percent of the Majors Creek population was acquired for the Grey Whale Ranch State park unit by California Department of Parks and Recreation (CDPR) in 1997. CDPR has recently approved a Public Works Plan (PWP) which would provide for immediate management actions until a Vegetation Management Plan can be developed. The PWP policy statement for Santa Cruz cypress states that no trails or public uses are proposed for the Santa Cruz cypress area (California State Parks 1997).

H. STRATEGY OF RECOVERY

Because threats of habitat alteration and destruction are no longer imminent, it is now possible to consider reclassifying Santa Cruz cypress from endangered to threatened status, if progress reported in this plan is confirmed.

Although only five populations of the Santa Cruz cypress exist, its life history as a long-lived perennial species reduces the number of individuals, and perhaps the number of populations, needed for recovery, compared to annual or short-lived perennial species. When Santa Cruz cypress was listed as an endangered species in 1987, it was threatened by alteration and destruction of habitat due to logging, agricultural conversion, and development. These threats are no longer imminent. Secondary threats noted in 1987 and later include the possibility that, in the absence of adequate legal protection, habitat destruction might resume in the future, perhaps from oil and gas drilling. It is also possible that the species could be threatened by introgression with other species of cypress, reproductive isolation or disruption of natural fire cycles.

The following actions are needed to remove the species from threatened status: 1) Protect significant habitat occupied by Santa Cruz cypress through purchase or voluntary non-fee-title agreements with landowners. 2) Conduct research on aspects of the cypress's life history (ecological requirements, fire ecology, and demography) needed to develop site-specific management plans or to improve existing plans, especially with respect to fire cycles, and with respect to preventing introgression with cultivated cypresses. 3) Develop and implement a long-term management plan for each population. These plans will be coordinated with conservation measures such as county ordinances, planning procedures, and landscaping regulations. 4) Develop a public education program; and 5) Establish an ex situ seed bank as a backup against disaster.

After Santa Cruz cypress is delisted, it must be monitored for a minimum of five years.

II. RECOVERY

A. OBJECTIVES AND CRITERIA

This part of the recovery plan outlines the management actions and research needed to protect all five populations of Santa Cruz cypress within its native range in Santa Cruz and San Mateo Counties, and to remove it from the list of threatened and endangered plants.

Santa Cruz cypress can be reclassified to threatened status when:

1. Protection is secured for all five populations and their habitat from the primary threats of logging, agricultural conversion, and development. Essentially all of the 142.4 hectares (356 acres) of known habitat is necessary to conserve the species.

Santa Cruz cypress can be delisted when:

2. All five populations are assured of long-term reproductive success, with insurance against failure provided by the availability of banked seed.

Recovery actions necessary to meet these objectives are outlined below. Despite implementation of these tasks, the species will continue to be limited to a few populations, and unless additional populations are discovered, the species will occupy a combined area of just 142.4 hectares (356 acres). Even when each population is protected and site-specific management guidelines have been implemented, it is still possible for a population to be extirpated by catastrophic events such as severe fire followed by lack of reproduction or die-off from disease. Therefore, establishment of a seed bank is necessary.

B. STEPDOWN NARRATIVE

1. Protect Habitat for Populations on Private Land with Permission of the Landowner.

Privately-held populations should be secured such that plans to manage the populations can subsequently be developed. The privately-held populations can be secured using several mechanisms: acquisition of property, gifts of easement or fee interest by the property owner, deed restrictions (provided restrictions cannot be changed privately without the knowledge of Federal, State and County agencies), acquisition of property rights (i.e., development rights, timber harvest rights), or permanent resource management easement.

11. Protect habitat for Bracken Brae population.

The Bracken Brae population encompasses approximately 4 hectares (10 acres); approximately 95 percent of the population is on three large parcels at the end of Hilltop Avenue while the remaining 5 percent of the population occurs in backyards of several single family residences along Hilltop Avenue at the perimeter of the stand. The landowners of all parcels within the Bracken Brae population are aware of the existence of Santa Cruz cypress on their property. They should be informed of the recovery effort and asked as to their interest in participating in the recovery effort.

The three large undeveloped parcels are in an area designated "suburban residential" in the Santa Cruz County General Plan, which allows one residence per 2 hectares (5 acres) (Richard Beale, land use consultant, pers. comm. 1994). The presence of the trees and complications with secondary access onto the parcels, however, limits the feasibility of development on the parcels. The current property owners should be asked as to their interest in selling their parcels to a local land conservancy. The Service or other private or public agencies could attempt to purchase the Santa Cruz cypress habitat on the site.

The Santa Cruz cypress occurring in yards of single family residences should be secured. One property owner has been active in monitoring the health of the trees on his property and appears to be interested in participating in the recovery effort. Possible mechanisms for securing habitat are listed above.

12. Protect habitat for Majors Creek population.

The Majors Creek population encompasses approximately 82 hectares (205 acres). Seventy percent of this population was acquired by CDPR in 1997, and the remaining portion is held by a private land owner. The private parcel is zoned for timber harvest. The private land owner is aware of the existence of Santa Cruz cypress on their property. They should be informed of the recovery effort and asked as to their interest in participating in the recovery effort.

13. Protect habitat for privately-owned portion of Bonny Doon population.

A six hectare (15 acre) portion of the Bonny Doon population has been subdivided into 10 privately owned parcels. The landowners of all parcels within the Bonny Doon population are aware of the existence of Santa Cruz cypress on their property. They should be informed of the recovery effort and asked as to their interest in participating in the recovery effort.

The Santa Cruz cypress on private land within the Bonny Doon population occur as specimen trees on 0.8–4.0 hectare (2–10 acre) single family residences. Some of the parcels abut the adjacent Bonny Doon Ecological Reserve; for these parcels, acquisition of property for incorporation into the Ecological Reserve may be desirable and of interest to property owners. Another mechanism for securing habitat may be the dedication of permanent resource management easements for the habitat on these private parcels by either a Federal Agency, State Agency, or a conservation group. Landowners who are agreeable to dedicating easements might or might not want to be compensated.

2. Broaden the understanding of the demographics, life history, and ecology of the Santa Cruz cypress.

Management of populations of Santa Cruz cypress is perhaps more difficult than protecting the sites. Management guidelines need to address site-specific threats to each of the populations. Before management plans can be developed, a better understanding of the population characteristics, and identification of those factors that may be affecting those characteristics is needed. Although initial demographic data has been collected on three of the five populations (Bracken Brae, Butano Ridge, and Eagle Rock) (Lyons 1988), none has been collected from the other two (Bonny Doon and Majors Creek). A more extensive effort to describe the demographic profile of each population should focus on identifying the life history stages critical to maintaining population viability (Schemske et al. 1994). When stands differ in age structure or size-class structure, the reasons for the differences should be identified so that appropriate management actions can be planned (see Task 3).

21. Describe the demographic profile of each population of Santa Cruz cypress and collect other relevant information needed to develop management guidelines.

Supplement initial demographic studies completed for Bracken Brae, Butano Ridge, and Eagle Rock populations with similar studies on the other two populations. The methods used could be similar to those used by Lyons (1988) or another appropriate method. Sampling should be extensive enough to detect differences in demographic profiles between stands within one population, or within a stand if the population consists of a single stand. Sampling should distinguish between critical life history stages, including but not limited to seedbank, seedlings, juveniles, subadults, reproductive adults (including fecundity), and senescent adults.

Along with sampling, information should be collected biotic and abiotic characteristics of the sampling sites, including but not limited to slope, aspect, elevation, soil characteristics, evidence of fire history, associated plant species, the

presence of non-native species, insects and diseases, proximity to other *Cupressus* species, and nature and degree of disturbance factors, if any.

22. Analyze demographic data to detect potentially limiting stages in life history.

Analyze data to determine variations in profiles within and between populations. Analyze correlations between demographic profiles and other site characteristics. Identify potentially limiting life history stages for each population (for instance, if there is no seedling establishment, or if fecundity of reproductive-aged adults is low or non-existent). Identify potential causes for such critical stages that may warrant further study.

23. Conduct further studies to identify the causes of limiting life history stages.

Task 22 may identify factors that warrant further study. Each population may have a different array of factors that warrant further investigation. Develop and conduct studies to determine the degree to which these factors limit critical life history stages of the cypress. These factors may include but are not limited to alteration of natural fire cycles (either too short or too long); stand succession; competition with invasive, non-native plant species; genetic contamination from other *Cupressus* species; the effects of insects and diseases; and secondary impacts from adjacent land uses such as development, logging, and agriculture occurring adjacent to the populations.

24. Evaluate data and develop management recommendation to be included in each population's management plan.

Data collected from the studies performed in Task 22 and 23 above should be evaluated to determine the need to address these factors in management plans for the populations. These results should also be incorporated in management plans that are subsequently developed for each population (Task 3).

3. Manage and Enhance Populations and Habitat.

Management of Santa Cruz cypress and its habitat will depend upon information gained from monitoring, threat analyses, and the evaluation of protection alternatives. There may be different management programs for each population. Development of management plans should include all interested and affected groups. The management program selected will require periodic review to ensure that it is effective in protecting the species.

31. Manage Bonny Doon Population.

Develop and implement best management practices for parcels within the Bonny Doon population to ensure conservation of the species.

311. Establish a working group to coordinate with private landowners and appropriate agencies to develop specific management practices for the Bonny Doon population.

For privately-owned parcels, establish interagency-landowner(s) coordination to develop resource management guidelines. Continue to have the CDFG coordinate on plans for the Bonny Doon Ecological Reserve with area residents.

312. Develop specific management guidelines for the Bonny Doon population.

Evaluate best management practices for each parcel to ensure conservation of the species, including prescribed/controlled burning, mechanical site disturbance and/or artificial regeneration if appropriate. Based upon level of threat on each parcel, prepare management guidelines to address control of invasive non-native plant species, insect/disease infestations, potential for artificial regeneration, buffer zones for non-compatible adjacent land uses and monitoring strategies.

Studies conducted in Task 2 will yield specific management recommendations. If insect (e.g., sawfly larvae) infestations are a threat, include recommendations

for natural controls if warranted. If invasive, non-native plant species are a threat, include recommendations for controls. Non-native plant invasion may be a problem only for cypress populations adjacent to land uses with seed sources of invasive non-natives, such as homes, land clearing activity, or intensive recreational uses.

The CDFG has recently completed a Draft Management Plan for the Bonny Doon Ecological Reserve (CDFG 1993) which includes about half of the Bonny Doon population. The plan outlines management actions for the entire reserve, including its cypress population. Management plan goals include: maintain and enhance populations of sensitive species and associated species, reduce fuel loads and protect adjacent properties from wildfire, and develop a mosaic of different-aged chaparral stands to reduce fire risk.

313. Implement specific management guidelines for Bonny Doon population.

Implement management guidelines with landowners (e.g., CRMP). Funding could be done through cost-sharing mechanisms, including multi-parcel funding and management. Funding may also be available through a local assessment district, volunteer/donated labor, agency funding or a combination thereof. Proceed with implementation of management guidelines.

32. Manage Majors Creek population.

Develop and implement best management practices for the parcels within the Majors Creek population to ensure conservation of the species.

321. Establish a working group to coordinate with the private landowners and appropriate agencies to develop specific management practices for the Majors Creek population.

For privately-owned parcels, establish interagency-landowner(s) coordination to develop resource management guidelines. CDPR should coordinate on plans for the Grey Whale Ranch park unit with area residents.

322. Develop specific management guidelines for the Majors Creek population.

Evaluate best management practices for this population, including prescribed/ controlled burning, selective thinning, mechanical site disturbance and/or artificial regeneration if appropriate. Based upon level of threat, prepare management guidelines to address the following: invasive non-native plant species, insect/disease infestations, the potential for artificial regeneration, buffer zones to non-compatible adjacent land uses, and monitoring strategies.

Include results of studies conducted in Task 2 in specific management recommendations. If insect (e.g., sawfly larvae) infestation are determined to be a threat, include recommendations for natural controls if warranted. If invasive non-native plant species are determined to be a threat, include recommendations for controls. Invasions of these non-native plant species may be limited to populations adjacent to urban/rural land uses that provide a seed source of invasive non-natives (homes, land clearing activity, and intensive recreational uses).

323. Implement specific management guidelines for the Majors Creek population.

Implement management guidelines with landowners (e.g., CRMP). Funding could be done through cost-sharing mechanisms, including multi-parcel funding and management. Funding may also be available through a local assessment

district, volunteer/donated labor, agency funding or a combination thereof. Proceed with implementation of management guidelines.

The CDPR acquired 70 percent of the Majors Creek population in 1997. A Vegetation Management Plan for the Grey Whale Ranch park unit is currently being developed. This plan should include management actions for the cypress, as have been identified in Task 322 above.

33. Manage Bracken Brae population.

Develop and implement best management practices for the numerous parcels comprising the Bracken Brae population to conserve the species.

331. Establish a working group to collaborate with the private landowners and appropriate agencies to develop specific management practices for the Bracken Brae population.

Establish an interagency-landowner(s) collaboration to develop resource management guidelines for the parcels that support the Bracken Brae population.

332. Develop specific management guidelines for the Bracken Brae population.

Evaluate parcel specific best management practices for this population including prescribed/controlled burning, selective thinning, mechanical site disturbance and/or artificial regeneration if appropriate. If warranted by the level of threat, prepare management guidelines to address control of invasive non-native plant species, insect/disease infestations, potential for artificial regeneration, buffer zones for non-compatible adjacent land uses and monitoring strategies.

Include results of studies conducted in Task 2 in specific management recommendations. If insect (e.g., sawfly larvae) infestation are determined to be a threat, include recommendations for natural controls if warranted. If invasive

non-native plant species are determined to be a threat, include recommendations for controls. Invasions of these non-native plant species may be limited to populations adjacent to urban/rural land uses that provide a seed source of invasive non-natives (homes, land clearing activity, intensive recreational uses).

333. Implement specific management guidelines for the Bracken Brae population.

Implement management guidelines with landowners (e.g., CRMP). Funding could be done through cost-sharing mechanisms, including multi-parcel funding and management. Funding may also be available through a local assessment district, volunteer/donated labor, agency funding or a combination thereof. Proceed with implementation of management guidelines.

34. Manage Eagle Rock Population.

Develop and implement best management practices for the Eagle Rock population to ensure conservation of the species.

341. Establish a working group to coordinate with State Department of Parks and Recreation and appropriate agencies to develop specific management practices for the Eagle Rock population.

Establish interagency coordination to develop resource management guidelines for the Eagle Rock population, which is entirely in Big Basin Redwoods State Park.

342. Develop specific management guidelines for the Eagle Rock population.

The CDPR is aware of the cypress population on their land in Big Basin Redwoods State Park. While CDPR desires to prepare the General Plan for the park that is mandated by park policy, preparation has not yet begun. When the plan is prepared, it should include management objectives for the cypress.

Include results of studies conducted in Task 2 in specific management recommendations. Guidelines for this population could consider prescribed/ controlled burning, selective thinning, and/or mechanical site disturbance to stimulate regeneration if appropriate. If warranted by the level of threat, prepare management guidelines to address control of invasive non-native plant species, insect/disease infestations, potential for artificial regeneration, buffer zones to non-compatible adjacent land uses, and monitoring strategies.

343. Implement specific management guidelines for the Eagle Rock population.

Investigate cost-sharing funding mechanisms with other State agencies and the Service to implement the management plan. For example, a prescribed burn program or selective thinning program for the population might be jointly funded with CDF. Proceed with implementation of management guidelines.

35. Manage Butano Ridge population.

Develop and implement best management practices for the Butano Ridge population to ensure conservation of the species.

351. Establish a working group to coordinate with San Mateo County Parks and Recreation Department (County) and appropriate agencies to develop specific management practices for the Butano Ridge population.

Establish interagency coordination to develop resource management guidelines for the Butano Ridge population.

352. Develop specific management guidelines for the Butano Ridge population.

The San Mateo County Parks and Recreation Department is aware of the cypress population on their lands in Pescadero County Park. The County has prepared

the Pescadero County Park Resource Management Plan, but the plan does not yet address specific actions for the cypress.

Management recommendations for the cypress could be amended to the Park's Resource Management Plan. Guidelines for this population should be based on results of studies conducted in Task 2, and include prescribed/controlled burning, selective thinning, and/or mechanical site disturbance to stimulate regeneration if appropriate. If warranted by the level of threat, prepare management guidelines to address control of invasive non-native plant species, insect/disease infestations, potential for artificial regeneration, buffer zones to non-compatible adjacent land uses and monitoring strategies.

353. Implement specific management guidelines for the Butano Ridge population.

Proceed with implementation of management guidelines. Agencies can sometimes save money by cooperating or even carry out activities that would be impossible for individual agencies. For example, a prescribed burn program or selective thinning program for the population might be jointly funded with CDF, so it is worth investigating cost-sharing funding mechanisms with State or Federal agencies.

4. Develop educational program.

An educational program should be established for the public, including private landowners, with Santa Cruz cypress populations and/or suitable habitat to encourage conservation and proper management of the species. Private groups such as the California Native Plant Society and the Santa Cruz Mountains Biodiversity Task Force should be approached about participating in this effort.

41. Develop educational materials.

Educational brochures and other materials (such as video or slide presentation) should be prepared that include discussion of the importance of the species to the region (e.g., legal status), plant identification, plant ecology and related management issues (e.g., use of fire or mechanical methods for species regeneration, recommended landscape species compatible for adjacent development). Separate brochures could be developed to target youth in public schools and an adult audience.

42. Implement educational program.

Distribute brochures and other educational materials through local public schools and directly to private landowners and other interested audiences in the local area.

5. Establish an *ex situ* seed bank for seed representing each of the five populations.

Due to the small numbers of individuals and populations of the Santa Cruz cypress, a seed bank should be established to maintain the genetic variability within and between populations as insurance against the possibility of stochastic extinction (extinction due to randomly-occurring events). The U.S. Forest Service Pacific Southwest Research Station in Albany, California has conducted preliminary analyses for genetic variability.

51. Determine genetic variability.

The U.S. Forest Service should be encouraged to expand their efforts to determine genetic variability within and between populations through isozyme testing.

52. Collect seeds and store at an established seed bank facility.

Based on the results of the analyses of Task 51, a seed collection program should be designed and implemented with the goal of representing all the genetic variability within and between populations. Seed could be stored at the U.S. Forest Service Experiment Station laboratory or another appropriate facility.

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III. IMPLEMENTATION SCHEDULE

The table that follows is a summary of scheduled actions and costs for the Santa Cruz cypress Recovery Plan. It is a **guide** for meeting the objectives discussed in Part II of this plan. The table includes the following five elements, which are further discussed below: 1) the task priority; 2) the task number and description; 3) the task duration; 4) which agencies are responsible for performing the tasks; and 5) cost estimates.

1. Priority. The actions identified in the Implementation Schedule are those that, in the opinion of the Service, should bring about the recovery of this species. However, the tasks are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions. The priority for each task is given in the first column of the implementation schedule, and are assigned as follows:

Priority 1:	An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
Priority 2:	An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
Priority 3:	All other actions necessary to provide for full recovery of the species.

2. Task Number and Description. The task number and description are extracted from the stepdown narrative found in Part II of the recovery plan. Please refer back to this narrative for a fuller description of each task.

3. Task Duration. The Task Duration column indicates the number of years estimated to complete the task if it is a discrete task, or whether it is a continual or ongoing task. Continual and ongoing tasks are defined as follows:

Cont = Continual. Task will be implemented on an annual basis once it is begun.
Ong = Ongoing. Task is currently being implemented and will continue until no longer necessary for recovery.

4. Responsible Parties. In the table, the Service has identified agencies and other parties that it believes are primary stakeholders in the recovery process. The list of potential stakeholders is not limited to the list below; other stakeholders are invited to participate. For each task, the most logical lead agency (based on authorities, mandates, and capabilities) has been identified as the "responsible party" with an asterisk. For some tasks, the responsible party essentially assumes all responsibility for implementing the task; for other tasks, the responsible party may assume responsibility for coordinating other stakeholders as well. The following abbreviations are used to identify primary stakeholders for each recovery task for the Santa Cruz cypress:

Responsible Parties (* designates lead agency):

CDFG = California Department of Fish and Game
CDF = California Department of Forestry
CDPR = California Department of Parks and Recreation
CPC = Center for Plant Conservation
PVT = Private parties
SBCO = San Benito County
SBPR = San Benito County Department of Parks and Recreation
SCCO = Santa Cruz County
USFS = U.S. Forest Service Research Station
USFWS = U.S. Fish and Wildlife Service

5. Cost Estimates. The estimated costs are shown for each recovery task for each of five years and as a total for all five years. The estimated costs include estimated salaries for individuals who would carry out the identified task. Typically, the responsible party (or lead agency) is shown as assuming the largest share of the cost, with other stakeholders shown as contributors. The inclusion of estimated costs in this recovery plan does not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these tasks is subject to the availability of funds as well as other constraints affecting the stakeholders involved.

Recovery Plan Implementation Schedule for Santa Cruz Cypress

PRIORITY	TASK NUMBER	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($1,000) TOTAL COST	FY 1	FY 2	FY 3	FY 4	FY 5	COMMENTS
		Secure habitat for populations on private land									
2	11	Protect Bracken Brae population	2	CDFG	2	1	1	0	0	0	
2	12	Protect Major Creek population	2	CDFG	2	1	1	0	0	0	
2	13	Protect Bonny Doon population	2	CDFG	2	1	1	0	0	0	
		Subtotal Cost:			6	3	3	0	0	0	
		Study demographics, life history, and ecology									
2	21	Characterize demographic profiles of populations	1	CDFG*	5	5	0	0	0	0	
				CDPR	2	2	0	0	0	0	
				USFWS	1	1	0	0	0	0	
2	22	Analyze demographic data	1	CDFG*	2	0	2	0	0	0	
				CDPR	1	0	1	0	0	0	
				USFWS	1	0	1	0	0	0	
2	23	Identify causes limiting life hiistory	1	CDFG*	1	0	1	0	0	0	
				CDPR	0.5	0	0.5	0	0	0	
				USFWS	0.5	0	0.5	0	0	0	
2	24	Develop management recommendations	1	CDFG*	3	0	0	3	0	0	
				CDPR	2	0	0	2	0	0	
				USFWS	1	0	0	1	0	0	
		Subtotal Cost:			20	8	6	6	0	0	
		Manage and Enhance Populations and Habitat (Priority 2 Tasks)									
2	311	Establish working group for Bonny Doon population	2	CDFG*	1	0	0	0.5	0.5	0	
				SCCO	0	0	0	0	0	0	
2	312	Develop management guidelines for Bonny Doon population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	313	Implement management plan for Bonny Doon population	Cont	CDFG*	2	0	0	0	1	1	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	

PRIORITY	TASK NUMBER	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($1,000) TOTAL COST	FY 1	FY 2	FY 3	FY 4	FY 5	COMMENTS
				USFWS	0	0	0	0	0	0	
2	321	Establish working group for Majors Creek population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	322	Develop management guidelines for Majors Creek population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	323	Implement management plan for Majors Creek population	Cont	CDFG	2	0	0	0	1	1	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	331	Establish working group for Bracken Brae population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	332	Develop management guidelines for Bracken Brae population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	333	Implement management plan for Bracken Brae population	Cont	CDFG*	2	0	0	0	1	1	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
		Subtotal Cost			12	0	2.5	3	3.5	3	
		Establish ex situ seed bank									
2	51	Study genetic variability	1	USFS*	2	2	0	0	0	0	
				USFWS	0	0	0	0	0	0	
2	52	Collect and store seed	Cont	USFS*	2.5	0.5	0.5	0.5	0.5	0.5	
		Subtotal Cost			4.5	2.5	0.5	0.5	0.5	0.5	

PRIORITY	TASK NUMBER	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY	COST ESTIMATES ($1,000) TOTAL COST	FY 1	FY 2	FY 3	FY 4	FY 5	COMMENTS
		Manage and Enhance Populations and Habitat: Priority 3 Tasks									
3	341	Establish working group Eagle Rock population	2	CDFG	1	0	0.5	0.5	0	0	
				CDPR*	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
3	342	Develop management plan for Eagle Rock population	2	CDFG*	1	0	0.5	0.5	0	0	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
3	343	Implement management plan for Eagle Rock population	Cont	CDFG*	2	0	0	0	1	1	
				SCCO	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
3	351	Establish working group Butano Ridge population	2	CDFG	1	0	0.5	0.5	0	0	
				SMCPR*	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
3	352	Develop management guidelines for Butano Ridge population	2	CDFG	1	0	0.5	0.5	0	0	
				SMCPR*	0	0	0	0	0	0	
				PVT	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
3	353	Implement management plan for Butano Ridge population	Cont	CDFG	2	0	0	0	1	1	
				SMCPR*	0	0	0	0	0	0	
				USFWS	0	0	0	0	0	0	
		Subtotal Cost:			8	0	2	2	2	2	
		Develop educational program									
3	41	Develop educational materials	1	PVT	0.5	0	0	0.5	0	0	
3	42	Implement educational program	1	PVT	0.5	0	0	0	0.5	0	
		Subtotal Cost:			1	0	0	0.5	0.5	0	
		TOTAL COST			**51.5**	**13.5**	**14**	**12**	**6.5**	**5.5**	

APPENDIX A: Summary of the Agency and Public Comments on the Draft Recovery Plan for Santa Cruz Cypress

On February 9, 1995, the Service released a partial draft recovery plan to selected parties for a 30-day review period. On June 6, 1997, the Service released the Draft Recovery Plan for Santa Cruz Cypress for a 60-day comment period that ended on August 5, 1997, for Federal agencies, State and local governments, and members of the public (62 Federal Register 33798).

In response to the two reviews, 11 letters were received from a total of 10 parties, each containing varying numbers of comments. Federal, State, and local jurisdictions that responded included the California Department of Fish and Game, the California Department of Parks and Recreation, and the County of San Mateo. Copies of the draft recovery plan were sent to a total of 32 interested parties. Of these, three individuals were asked to peer review the document; all three peer reviewers responded. Peer reviewers were selected on their familiarity with either a taxonomic group, a geographic area, and/or jurisdictional issues.

The number of parties responding, by affiliation:

Federal agencies	1
State agencies	2
Local governments	1
Environmental/conservation organizations	4
Academia/professionals	3
Members of the public	2

Summary of Significant Comments and Service Responses

The Service reviewed all of the comments received during the two comment periods. Comments that were either technical in nature, or were updating the information in the draft recovery plan have been incorporated into the appropriate section of the recovery plan.

The issue of using controlled burning as a management tool generated the most discussion. Several commenters perceived that the Service was advocating the use of controlled burns to stimulate stand regeneration. Commenters were concerned about the

following: the lack of research proving that burning would achieve desired results; more stringent air quality and water quality standards that would make it difficult to conduct burns; and the possibility of catastrophic event during a controlled burn due to steep, rugged terrain and heavy fuel loads in adjacent forest types. Selective thinning was recommended as another management tool. The Service does not necessarily advocate controlled burning, and believes each of the five sites needs to be evaluated individually for management needs.

To de-emphasize the use of controlled burning, the following minor changes have been made to the recovery plan: under tasks relating to the development and implementation of specific management guidelines for the populations, selective thinning was added to the list of examples of potential management tools.

Several other comments were received that were theoretical or philosophical in nature, and not directly relevant to the Service's mandate to develop this plan. The Service took note of those comments, but in most cases they did not result in a change to the recovery plan. The Service did not receive any comments that it considered controversial or significant in the sense of making a difference in the fundamental way that recovery of the two plant species is being approached. Any interested parties with outstanding concerns are invited to contact the Service at the address below:

U.S. Fish and Wildlife Service
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